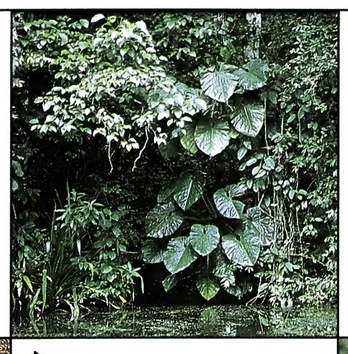
The Araceae Family

Research at the Missouri Botanical Garden

The aroid or philodendron family, Araceae, has 105 genera and 2,500-3,000 species. More than two-thirds of these species occur in the New World. Over half of these are *Anthurium*, the largest genus in the family, with over 1,000 species. The leaf veins of aroids often form net-like patterns, except in most species of subfamily Philodendroideae, and in genera *Acorus* and *Gymnostachys*, which have the typical parallel veins of grasses and other monocots. **The family is complex and poorly known taxonomically.** It traditionally has been divided into eight subfamilies, but recent and rather radically different systems, one by Grayum of the MBG staff and the other by Bogner & Nicolson, divide the family into five and nine subfamilies respectively. The heart-shaped philodendron, *Philodendron scandens*, pictured left, is a popular and easily recognizable member of Araceae. [2]

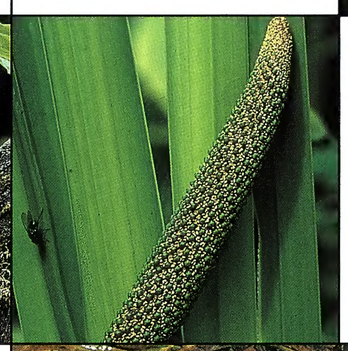


Distribution—Tropics: Tropical evergreen rain forests cover 7% of the world's surface. 170,000 plant species, about two-thirds of the world's total, occur only in the tropics. Many are unknown scientifically and in danger of extinction. Since the Araceae was described in MBG's Flora of Panama project in 1944, collections in Panama have increased known species of aroids by 355%. Left: *Philodendron pterotum*. [3]

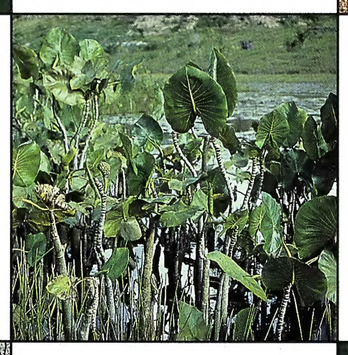
MBG Research—Dr. Thomas B. Croat, P. A. Schulze Curator of Botany, right, and Dr. Michael H. Grayum, Associate Curator, are MBG experts in the Araceae. MBG research programs, in collaboration with scientists worldwide, provide indepth studies of tropical plant groups and inventories of selected regions. These are often **used to suggest conservation strategies to help preserve global biological diversity.** [11]

Distribution—Mediterranean: This region is a local area of diversity for genera adapted to xeric, or dry, conditions. Five endemic genera, *Biarum, Ambrosina, Dracunculus, Helicodiceros,* and *Arisarum,* occur only there. All have tuberous stems and survive part of the year in a leafless condition. The purple spathe and spadix of *Eminium lehmannii,* right, stand out, advertising its foetid odor, which attracts flies. [4]

Distribution—Temperate: North America has seven genera of aroids, *Arisaema, Peltandra, Orontium, Calla, Symplocarpus, Pistia,* and *Lysichiton*. *Arisaema,* the third largest genus in the family, includes the only aroids known to be functionally dioecious, changing from male to female and back as environmental conditions dictate. *Arisaema ciliatum,* at right, from China, shows the typical jack-in-the-pulpit type inflorescence. [5]



Classification—Evaluation: *Acorus,* or sweet flag, long considered to be an aroid, has many characteristics that separate it from other Araceae and has recently been removed from the family by most aroid researchers. It occurs in Europe, temperate and subtropical Asia, and North America. *Acorus calamus,* left, has ancient uses as a medicinal plant for treatment of colic, dysentery, and burns. [2]



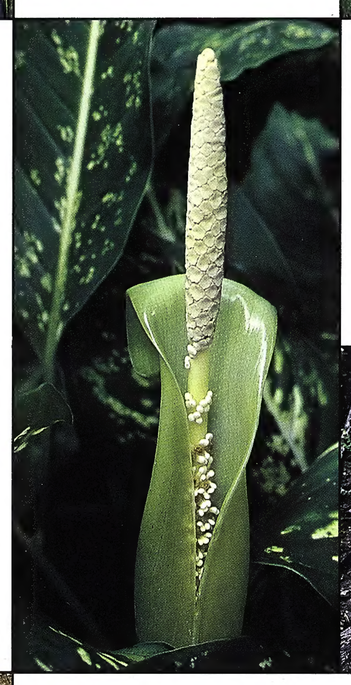
Habit—Emergent Aquatic: Most temperate North American aroid species are aquatic or are associated with marshy habitats. The Old World genera *Cryptocoryne* and *Lagenandra* are popular as aquarium plants. The stems of *Montrichardia linifera,* a tree-like aquatic in South America, right, are usually held permanently below water level and are flexible enough to bend with changing water currents. [9]

Habit—Floating Aquatic: The spongy leaves and floating aquatic habit of *Pistia stratiotes,* pictured, a monotypic genus found in all tropical areas, **are unique in the family.** Just 1 cm long, its inflorescence is the smallest in the family. *Pistia* usually reproduces vegetatively and may aggressively cover the surface of small freshwater lakes. It was believed to be a distant relative of Lemna in the duckweed family. [6]

Habit—Submerged Aquatic: A rare aroid is *Jasarum steyermarkii,* at right, the only species in its genus and the only wholly submerged aquatic aroid in South America. Its inflorescence rises above water level during flowering, but its leaves never do. It is named in honor of the late Dr. Julian A. Steyermark of MBG, who holds the Guinness World Record for collecting 132,223 plants. [7]

Habit—Epiphyte: About 25% of all species in wet tropical areas are epiphytes, plants that have no roots into the soil but obtain water and nutrients directly from the air. Their seeds germinate and thrive on the host tree. **About 49% of all aroids are hemiepiphytes** like the Central American *Anthurium ravenii,* above, which spends part of its life connected to the soil. The plant is named in honor of Dr. Peter H. Raven, Director, MBG. [3]

Floral Adaptations—Spathe and Spadix: An inflorescence is the arrangement of flowers on a floral axis. In Araceae, it consists of the spathe, a highly modified, often colorful bract and the spadix, or thickened spike bearing the flowers. Inflorescence and flower characteristics are important in the taxonomy of the family. Flowers are either bisexual and scattered throughout the spadix, or are unisexual with male flowers often separated from female flowers by a zone of sterile male flowers. Flowers may be naked, as in *Monstera,* or have tepals (floral segments) as in *Anthurium*. Flower development typically begins at the base of the spadix. Ovaries are protected by specialized cells and/or needle-like crystals containing oxalic acid, or sometimes simply by thickened tepals. Pictured right: *Dieffenbachia seguine.* [2]



Subfamily—Lasiodeae: The group is characterized by netted venation, a typically unconstricted persistent spathe with bisexual flowers, and frequently hastate or compound leaf blades. Grayum lists 80 species but retains *Anthurium* in subfamily Pothoideae, Bogner & Nicolson list 1210 species and place it in Lasiodeae. The spathe of *Lysichiton camtschatcensis* of Asia, at right, produces a skunk-and-cabbage scent. [1]

Subfamily—Pothoideae: The group is characterized by netted venation, often winged petioles, an unconstricted spathe, and by bisexual flowers. Grayum lists 1300 species and includes Monsteroideae in Pothoideae; Bogner & Nicolson list 52. *Pothos scandens,* at right, has leaf-like petioles called phyllodes, a geniculum, or swollen joint, to bend its leaf blade in accordance to light levels, and a pea-sized spadix. [2]

Inflorescence: Amorphophallus titanum has one of the world's largest inflorescences, growing about 3 meters tall. It is native to Sumatra and is known locally as "bunga bangkai", or corpse flower. Beetles act as pollinators. Despite its revolting odor, the unusual plant is prized in greenhouses and gardens alike. It belongs to the **subfamily Aroideae,** characterized by its terrestrial, rhizomatous, or tuberous habit, netted venation, usually constricted spathe and unisexual, naked flowers. Grayum lists 410 species; Bogner & Nicolson list 360 species in this subfamily. Many members are adapted to growing in harsh conditions in seasonal climates. Pictured left: writer Deni Bown, right, with *Amorphophallus titanum,* and a native guide in Sumatra. [2]

Subfamily—Monsteroideae: This group is characterized by a typically climbing habit, uniform spadix with bisexual flowers, a spathe that falls away quickly, and by the frequent presence of heteroblastic leaf development. Heteroblasty is a condition where leaf form alters markedly between juvenile, preadult, and adult stages. **Monstera seedlings grow as leafless vines along the forest floor toward darkness, or skototropically,** until reaching the base of a tree. Juvenile shingle leaves are sometimes produced as it climbs the tree toward light, pictured left, until adult leaves are formed. **Fenestration, the occurrence of natural holes in leaves, is another distinctive feature of this group.** Pictured far left: *Monstera deliciosa,* or swiss cheese plant, is a popular houseplant. [2,3]

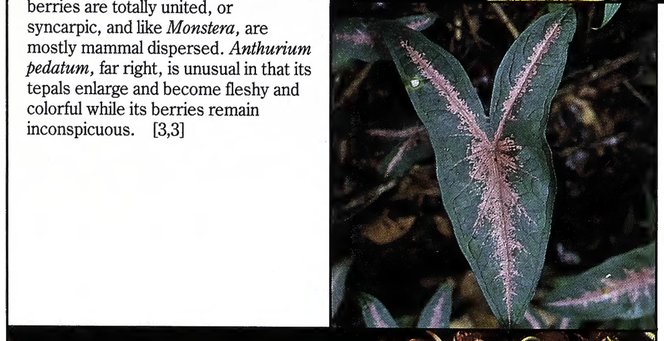
Subfamily—Colocasioideae: This group, with fewer than 175 species, is characterized by thick rhizomes or tubers, milky or reddish sap, blades with several collective veins, and a constricted spathe with unisexual flowers. *Xanthosoma sagittifolium,* above, is grown as a root crop in Florida for Malanga, a popular Cuban dish. Other edible aroids include *Amorphophallus paeoniifolius,* elephant yam, and *Alocasia macrorrhiza,* giant taro. [3]

Pollination by Flies: Many aroids are fly-pollinated. Inflorescences produce scents reminiscent of rotting fruits, rotting meat, feces, or yeast. The spathe and spadix of the hairy arum, *Helicodiceros muscivorus,* at right, is covered with coarse hairs and resembles a decaying animal hide, complete with a putrid odor which attracts flies. It is found in the Mediterranean on Corsica, Sardinia, and the Balearic islands. [2]

Pollination by Bees: Some *Anthurium* species are pollinated by euglossine bees that visit the flowering spadices to collect waxy scent compounds used to attract mates. Pistils, or female structures, typically mature before stamens, or male structures. Hybridization studies have shown that species usually cross only within sections of a genus or sometimes within the whole genus itself. Pictured *Anthurium obtusilobum* in Costa Rica. [3]

Economic crop—Taro: The Araceae contains several important root crops. Taro, *Colocasia esculenta,* pictured right, has been grown in Asia for over 10,000 years. The corms are eaten like potatoes or ground into flour, providing a good source of carbohydrate and potassium. "Poi" is eaten fresh or fermented as a side dish. Processed taro, used in baby foods, has very small starch grains that are easily digestible. [10]

Fruits: What aroid flowers may lack in color, they often make up for in showy fruits. Unripe berries may change from inconspicuous green to white, yellow, orange, red, or purple when seeds are fully developed and ready for dispersal. The typical berries of *Anthurium colonicum,* right, are protected by tepals until ripe and then are displayed for bird dispersal; *Dieffenbachia* and *Philodendron* berries remain enclosed within the spathe until fruits are mature, then the spathe falls away; and *Syngonium* berries are totally united, or syncarpic, and like *Monstera,* are mostly mammal dispersed. *Anthurium pedatum,* far right, is unusual in that its tepals enlarge and become fleshy and colorful while its berries remain inconspicuous. [3,3]



Horticulture: The Araceae is the preeminent family of ornamentals. The waxy, scarlet-flowered *Anthurium andraeanum,* or flamingo flower, was discovered in 1876 in Colombia and became the backbone for the Anthurium commercial cut flower market in Hawaii, today a multimillion dollar industry with hundreds of cultivars, below left. *Zantedeschia aethiopica,* calla lily, is another aroid popular for its flower. **Some aroids are also noteworthy for their colorful, ornate leaves marked by unusual shapes and textures.** *Caladium bicolor* hybrids, left, are widely used as border plants and ground cover in home landscapes. [2,2]

Although the Araceae is worldwide in distribution, the family is overwhelmingly tropical. The MBG research program concentrates on tropical forests, most of which are likely to be destroyed or permanently altered in the coming decades.

Horticulture: Seven of the thirteen best-selling ornamental foliage genera in the U.S. are aroids: *Spathiphyllum,* at left, *Dieffenbachia, Epipremnum (Rhaphidophora), Aglaonema, Philodendron, Syngonium,* and *Anthurium*. *Aglaonema pictum* 'Tricolor', below, has been popular for years, while species of *Homalomena,* above, have recently been introduced. [3,2,2]

Research: Living plants form an integral part of the MBG research program. Over 6,000 aroid specimens are in cultivation in the research greenhouse, pictured below. The greenhouse features a moss-lined, six meters high wall for hemiepiphytic climbers and a fogging unit to create high humidity. The aroid collection is used by researchers in botany, cytology, anatomy, and phytochemistry. The collection is cataloged in a computerized record system, HORTICULTURE, that quickly provides plant status, location, flowering dates, and cultural treatments. Field collection information and plant descriptive data are stored in TROPICOS, a computer database system developed at MBG that provides integrated plant information to botanists, conservationists, and land use experts around the world. [8]

Dedication

Anne Lionberger Lehmann
1894-1991

This poster is dedicated to Mrs. Anne L. Lehmann who, together with her late husband, John S. Lehmann, was a friend of the Garden for sixty years, supporting capital and programmatic activities that have helped to make the Garden's education, display, and research world renowned.

Research at the Missouri Botanical Garden

Forty-four Ph.D.-level scientists, eleven of whom live abroad, technical staff and graduate students devote their energies to collecting and studying plants and to exploration of selected regions. These efforts are concentrated in northwestern South America, Central America, Africa and Madagascar.

The individual scientists are specialists in the plants of particular regions or in the classification of certain plant families, such as the economically important grass, legume, and nightshade families. Their research is carried out in collaboration with scientists of the countries in which they are actively working. Together they are attempting to contribute to a common knowledge of the plants that sustain us all, with a view toward conserving and properly utilizing them.

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